

Chitons from the coralline area of Oaxaca, Mexico (Polyplacophora)

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Abstract

The polyplacophoran fauna from the rocky-coralline system of Oaxaca, in the Mexican Tropical Pacific, consists of 13 species, including either endemic and widely distributed species. Chitons were collected in eight localities along the central area of Oaxaca, at 0-7 m of depth. *Lepidochitona* (*L.*) *salvadorensis* is recorded for the first time from Mexican waters. New data of distribution are reported for *Lepidozona* (*L.*) *serrata*, *Stenoplax* (*S.*) *mariposa* and *Acanthochitona arragonites* all previously known only from the Gulf of California. *Chiton* (*C.*) *albolineatus* is confirmed as an endemic species of the Mexican Tropical Pacific. Two species, *Lepidochitona* sp. and *Ischnochiton* sp., are probably new and will be described when more material will be available. Each species is systematically treated, commented and illustrated.

Riassunto

Negli ambienti di natura roccioso-corallina di Oaxaca, nel Pacifico Tropicale del Messico, sono state individuate 13 specie di chitoni. Sono presenti sia elementi endemici, sia elementi ad ampia distribuzione geografica. I chitoni studiati provengono da otto località nel settore centrale di Oaxaca, e sono stati raccolti a profondità di 0-7 m. *Lepidochitona* (*L.*) *salvadorensis*, in precedenza nota solo per El Salvador, viene segnalata per la prima volta in acque messicane. Nuovi dati di distribuzione vengono riportati anche per *Lepidozona* (*L.*) *serrata*, *Stenoplax* (*S.*) *mariposa* e *Acanthochitona arragonites*, tutte note in precedenza solo per il Golfo di California. *Chiton* (*C.*) *albolineatus* risulta essere una specie endemica del Pacifico Tropicale del Messico. Vengono segnalate due specie, *Lepidochitona* sp. ed *Ischnochiton* sp., probabilmente nuove ed in attesa di essere descritte sulla base di materiale supplementare. Tutte le specie ritrovate sono trattate sistematicamente ed illustrate.

Key words

Polyplacophora, Mexico, Oaxaca, systematics, distribution.

Introduction

The study of chitons in Mexico has been raised in the last two decades; the latest works are about *Chiton* (*C.*) *articulatus* (Flores-Campana et al., 2006) and its population structure from Pájaro and Venados Island in Mazatlán, and the study about chitons of La Paz (García-Ríos, 2007). Both contributions represent an excellent effort to generate new studies. Although there are other areas where exploration is needed, besides the over explored Baja California Peninsula and the Gulf of California, this is the case of the Mexican Tropical Pacific.

It is a fact that in Mexico there are habitats of special interest, due their fragility, closeness and exposure to urban areas, like the reefs and shores of Oaxaca, where the expeditions and collecting campaigns have been few or almost null. This coralline reef system is located in the Mexican Tropical Pacific, at the western coast towards the very south of Mexico (Fig. 1). This area comprises the distant Tropical Eastern Pacific, with smaller wealth of coral species, since it counts on around 50 species, whereas in Indo-Pacific 500 species are recorded (Glynn & Leyte-Morales, 1997). This system is composed by 26 coralline formations and this particular region is isolated from other coralline areas like those at the North of Mexico at Guerrero, Michoacán and far

down to Central America, Guatemala, Salvador, Honduras and Nicaragua (Ramírez-Luna & Barrientos-Luján, 1999).

Here we present the first study on chitons from a coralline region at the Mexican Tropical Pacific, providing data on their distribution in the area.

Material and methods

The specimens were collected in living and dead coralline areas and rocky shores of Oaxaca, from several sites within this area and along 145 km of coast, between Bachoco beach and the Copalita River. Eight collecting sites were studied: Puerto Escondido (Puerto Angelito), Bahías de Huatulco (Casa Mixteca, Chachacual-Jicaral, Cacaluta) and Puerto Ángel (Estacahuite) (Fig. 1). The specimens were obtained from semi-monthly samplings (every-other month) during 1994 and 1995; in addition, we also included material collected in sporadic samplings within the same area from 1999 to 2008.

This habitat displays a high diversity of algae and invertebrate species and it is characterized for its rocky-coralline bottom substrate, composed by living and dead coral heads with up to 5 m of height, down to a depth of 14 m. The main coral genus is *Pocillophora*,

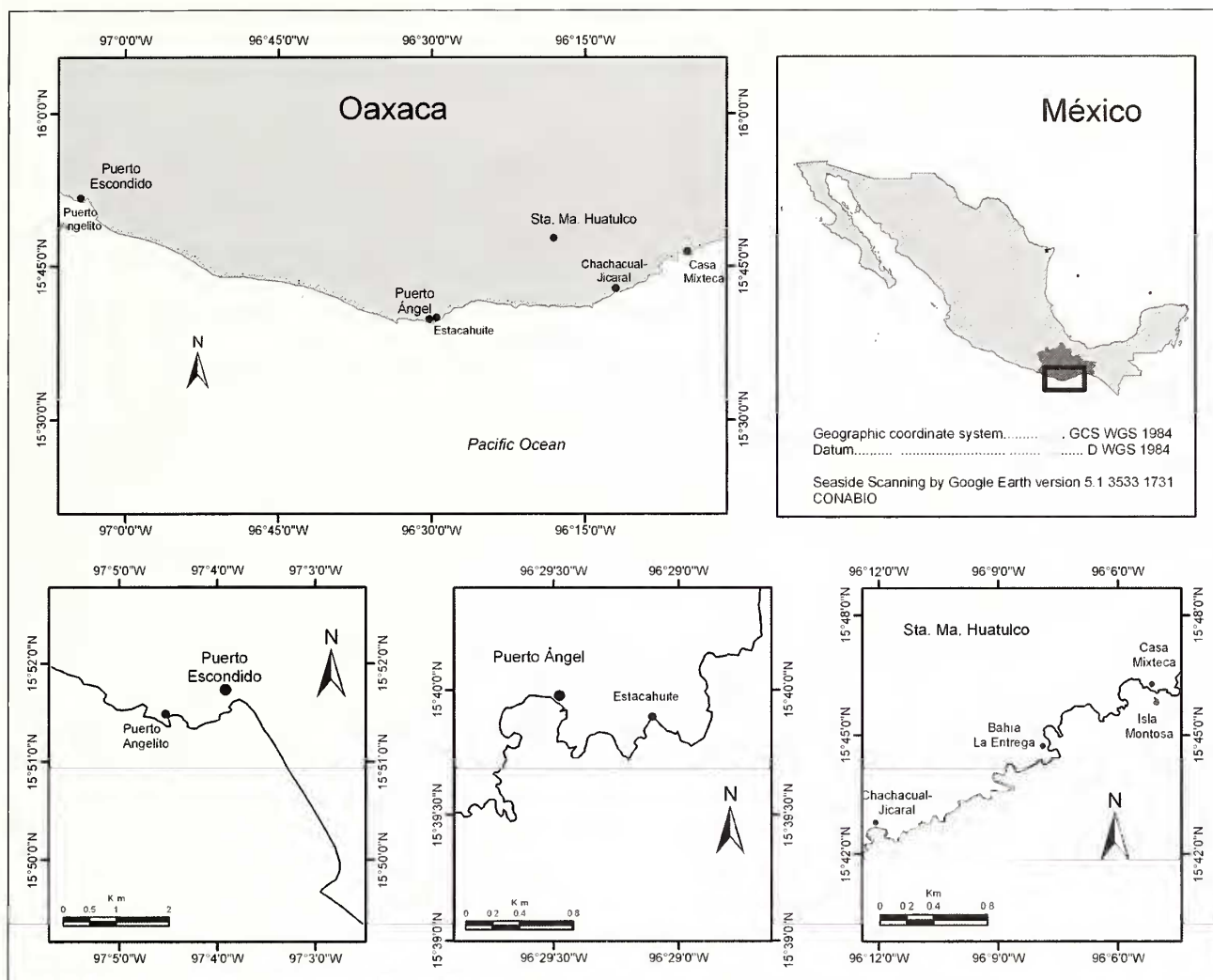


Fig 1. Collecting areas in the coral system at Oaxaca, Mexico.

Fig 1. Aree di raccolta nel sistema corallino di Oaxaca, Messico.

with the 90% of occurrence in all sampling points; but smaller coverage areas of other coralline genera are present, like *Pavona*, *Psammocora*, *Leptoseris*, *Fungia* and *Porites*.

Chitons were collected from coral localities by SCUBA diving at depth of 4-7 m, whereas rocky-shore chitons were collected by hand. In both cases the specimens were preserved in 70% ethanol. Specific data for each species are indicated in the paper. All specimens were studied using a stereomicroscope and compared with species known to occur in the region (Kaas & Van Belle, 1985, 1990, 1994; Reyes-Gomez & Salcedo-Vargas, 2002). Selected specimens were photographed in dorsal view with a digital camera (Figs 2). *Lepidochitona* (*Lepidochitona*) *salvadorensis*, *Lepidochitona* sp. and *Ischnochiton* sp. were also examined by SEM (Fig. 3).

All the study material is held in the Mollusc Collection of the Universidad del Mar, Oaxaca, Mexico (MHNU-MAR-003).

Results

Thirteen chiton species were identified in the area, representing six subfamilies and nine genera (Tabs. 1, 2):

Lepidochitona Gray, 1821, *Toncia* Gray, 1847, *Chaetopleura* Shuttleworth, 1853, *Ischnochiton*, Gray 1847, *Stenoplax* Carpenter ms, Dall, 1879, *Callistoplax* Carpenter ms, Dall, 1882, *Lepidozona* Pilsbry, 1892, *Chiton* Linné, 1758 and *Acanthochitona* Gray, 1821. Taxonomic remarks on the species and comments about the differences between our specimens and those reported from different areas are reported in the systematic section.

The species were found between the shore (0 m) and a depth of 7 m, on rocky-coral, sandy bottom, on dead and living coral. Most of the chitons were seen associated with red and brown algae.

Systematics

Family Ischnochitonidae Dall, 1889

Genus *Lepidochitona* Gray, 1821

Lepidochitona (*Lepidochitona*) *salvadorensis*

García Ríos, 2006

(Figs 2A, 3A, B)

Lepidochitona (*L.*) *salvadorensis* García-Ríos, 2006: p. 206, figs 1-10.

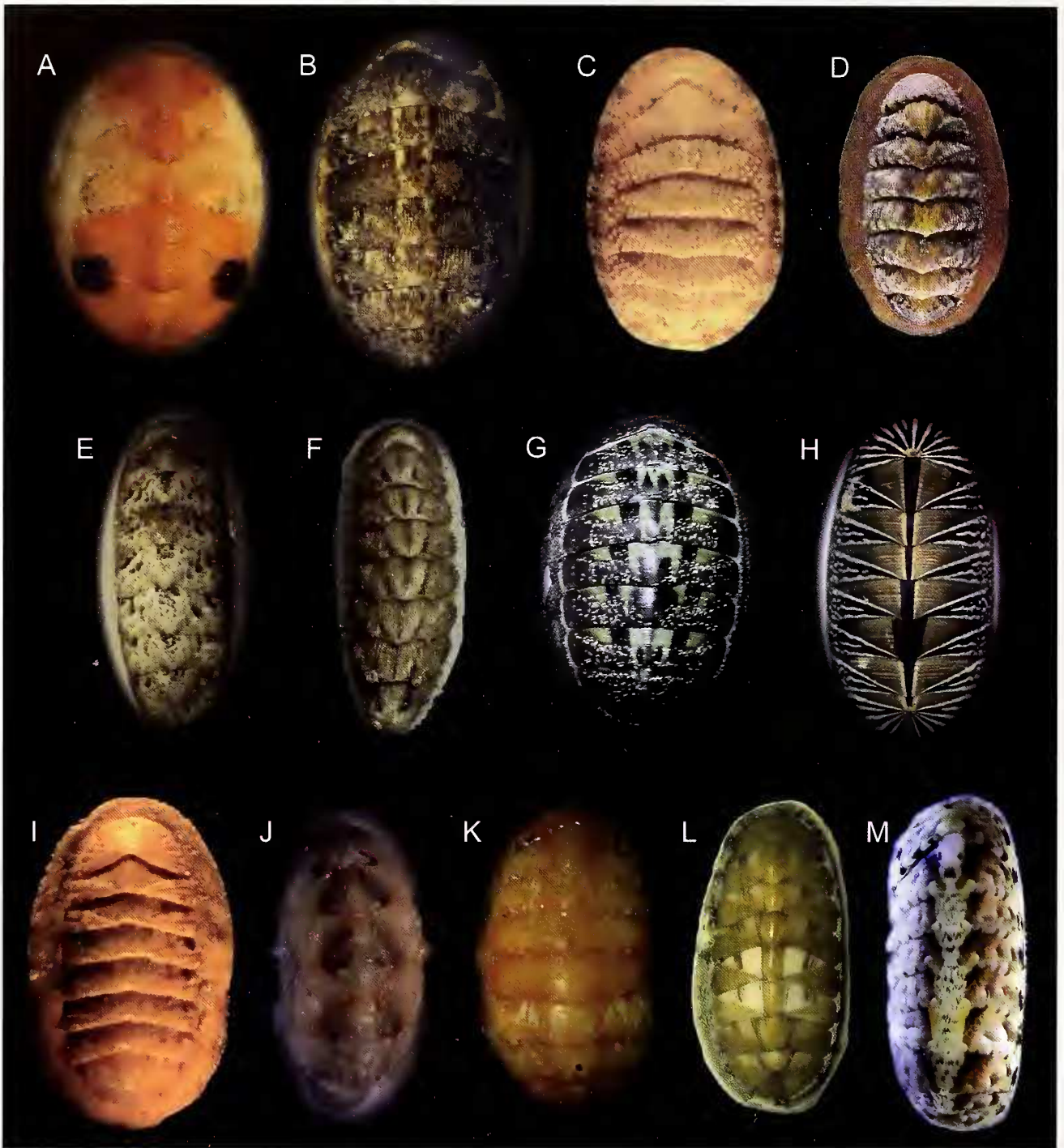


Fig. 2. Chitons in dorsal view. **A.** *Lepidochitona (L.) salvadorensis* (García-Ríos, 2006), Estacahuite, Puerto Ángel, 7.0 × 5.0 mm (MHNUMAR-003-00571). **B.** *Chaetopleura (Chaetopleura) lurida* (Sowerby, 1832), Puerto Angelito, 28.4 × 16.1 mm (MHNUMAR-003-01074). **C.** *Chaetopleura (Chaetopleura) hanselmani* (Ferreira, 1982), Casa Mixteca, Bahías de Huatulco, 7.0 × 5.0 mm (MHNUMAR-003-00935). **D.** *Toncia forbesii forbesii* (Carpenter, 1857), Chachacual-Jicaral, Bahías de Huatulco, 40.9 × 21.6 mm (MHNUMAR-003-00216). **E.** *Stenoplax (Stenoplax) limaciformis* (Sowerby, 1832), Puerto Angelito, 42.4 × 13.4 mm (MHNUMAR-003-01076). **F.** *Callistoplax retusa* (Sowerby in Broderip & Sowerby, 1832), Chachacual-Jicaral, 20.0 × 8.0 mm (MHNUMAR-003-01077). **G.** *Chiton (Chiton) articulatus* (Sowerby in Broderip & Sowerby, 1832), Estacahuite, Puerto Angel, 24.3 × 12.2 mm (MHNUMAR-003-01073). **H.** *Chiton (Chiton) albolineatus* (Broderip & Sowerby, 1829), Cacaluta, Huatulco Bays, 51.1 × 24.9 mm (MHNUMAR-003). **I.** *Lepidozonia (Lepidozonia) serrata* (Carpenter, 1864), Chachacual-Jicaral, 13.0 × 6.0 mm (MHNUMAR-003-00572). **J.** *Acanthochitona arragonites* (Carpenter, 1857), Estacahuite, 8.1 × 3.3 mm (MHNUMAR-003-01070). **K.** *Lepidochitona* sp., Estacahuite, 7.2 × 4.6 mm (MHNUMAR-003-00012). **L.** *Ischnochiton* sp., Estacahuite, 21.7 × 10.4 mm (MHNUMAR-003-00014). **M.** *Stenoplax (Stenoplax) mariposa* (Bartsch ms, Dall, 1919), Estacahuite, 21.7 × 10.4 mm (MHNUMAR-003-00016).

Fig. 2. Chitoni in vista dorsale. **A.** *Lepidochitona (L.) salvadorensis* (García-Ríos, 2006), Estacahuite, Puerto Ángel, 7,0 × 5,0 mm (MHNUMAR-003-00571). **B.** *Chaetopleura (Chaetopleura) lurida* (Sowerby, 1832), Puerto Angelito, 28,4 × 16,1 mm (MHNUMAR-003-01074). **C.** *Chaetopleura (Chaetopleura) hanselmani* (Ferreira, 1982), Casa Mixteca, Bahías de Huatulco, 7,0 × 5,0 mm (MHNUMAR-003-00935). **D.** *Toncia forbesii forbesii* (Carpenter, 1857), Chachacual-Jicaral, Bahías de Huatulco, 40,9 × 21,6 mm (MHNUMAR-003-00216). **E.** *Stenoplax (Stenoplax) limaciformis* (Sowerby, 1832), Puerto Angelito, 42,4 × 13,4 mm (MHNUMAR-003-01076). **F.** *Callistoplax retusa* (Sowerby in Broderip & Sowerby, 1832), Chachacual-Jicaral, 20,0 × 8,0 mm (MHNUMAR-003-01077). **G.** *Chiton (Chiton) articulatus* (Sowerby in Broderip & Sowerby, 1832), Estacahuite, Puerto Angel, 24,3 × 12,2 mm (MHNUMAR-003-01073). **H.** *Chiton (Chiton) albolineatus* (Broderip & Sowerby, 1829), Cacaluta, Huatulco Bays, 51,1 × 24,9 mm (MHNUMAR-003). **I.** *Lepidozonia (Lepidozonia) serrata* (Carpenter, 1864), Chachacual-Jicaral, 13,0 × 6,0 mm (MHNUMAR-003-00572). **J.** *Acanthochitona arragonites* (Carpenter, 1857), Estacahuite, 8,1 × 3,3 mm (MHNUMAR-003-01070). **K.** *Lepidochitona* sp., Estacahuite, 7,2 × 4,6 mm (MHNUMAR-003-00012). **L.** *Ischnochiton* sp., Estacahuite, 21,7 × 10,4 mm (MHNUMAR-003-00014). **M.** *Stenoplax (Stenoplax) mariposa* (Bartsch ms, Dall, 1919), Estacahuite, 21,7 × 10,4 mm (MHNUMAR-003-00016).

Material examined

MHNUMAR-003-01075. A single specimen was collected (7 mm long, 4 mm wide) at Estacahuite, Puerto Ángel. It was found in the low intertidal region, less than 1 m of depth, on dead coral in a sandy sheltered area. Within the locality we observed the presence of green, brown and red algae. The specimen corresponds to the description given by García-Ríos (2006).

Description

Small sized chiton. Elongate oval shape; color mainly red; valves II and III predominantly lighter, with tiny dark spots on edges. Valves generally carinated, mucronated; tegmentum smooth and poorly defined lateral areas. Head valve semicircular, not notched in the middle; tail valve semicircular with central mucro and concave postmucronal slope. Articulamentum weakly developed; insertion plates short; slit formula 8-9/1/7-11. Girdle wide, covered with very small, juxtaposed, hyaline globulose spicules interspersed along the girdle's base or bunched in groups of 3-4 arranged in around 20 tufts. Radula with a central tooth twice longer than wide, major lateral tooth with a tridentate cusp. Gills holobranchial arranged along 80% of the foot.

Distribution

Lepidochitona (*L.*) *salvadorensis* was first reported from two localities: Los Cóbano, Sonsonate and Playa Maculís, La Unión, El Salvador (García Ríos, 2006). The distribution of this species is notably wider than originally known, ranging from Guerrero (A. Reyes, pers. obs.) and Oaxaca, Mexico to El Salvador, Central America.

Remarks

García-Ríos (2006) presented a complete and good description of this species and a comparison with *Lepidochitona* (*L.*) *beanii* (Carpenter, 1857). He observed differences mainly in the position of the tufts of hyaline spicules and the dorsal scales of the girdle, only present in *Lepidochitona* (*L.*) *salvadorensis*, and in the smaller size of the major lateral tooth in this species. He also remarked several similarities with *Lepidochitona* *corteziana* Clark, 2000, especially in size, shape and colour. However, *L. corteziana* lacks of bundled hyaline spicules at the girdles base; its slit formula is higher in number especially in the head and tail valve and finally the girdle elements are less complex than in *Lepidochitona* (*L.*) *salvadorensis*.

Our specimen shows the typical characters as described by García-Ríos (2006). Two large dark spots are present laterally on VI (Fig. 2A).

Family Chitonidae Rafinesque 1815

Subfamily Tonicinae, Pilsbry, 1893

Genero *Tonicia* Gray, 1847

Tonicia forbesii forbesii Carpenter, 1857 (Fig. 2D)

Tonicia forbesii Carpenter, 1857: p. 7.

Tonicia forbesii Torphe in Keen, 1971: p. 864, fig. 9.

Tonicia forbesii Smith, 1977: p. 254.

Material examined

MHNUMAR-003-00216; MHNUMAR-003-01068. Four specimens were observed (respectively 23.7 × 38.2 mm, 20.0 × 37.6 mm, 18.7 × 35.9 mm, 18.5 × 36.2 mm), two from Chachacual-Jicaral, Bahías de Huatulco, and two from Estacahuite, Puerto Ángel. The specimens were found in 50% of living coral and rocky-coral bottom at a depth of 2-4 m.

Description

Large sized chiton, 23 to 38 mm in length; oval shape. Background colour of shell whitish with darker brown or olive streaks on lateral areas; some specimens can display fine wrinkly lines or suffusions of blue. Head valve semicircular; intermediate valves with front margin wavy, somewhat slanting towards the rounded side margins; blunt apex. Lateral areas moderately raised, sculptured as head valve consisting of strong longitudinal ridges. Central areas with low wavy oblique or longitudinal ridges, and narrow raised longitudinal ridges along jugum. Ocella present, black rounded and distributed mainly along edges of valves, easy to identify. Articulamentum whitish; apophyses with the front sinuose; jugal sinus rather deep with a short dentate plate. Slit formula 8-9/1/12-14. Girdle smooth and wide, brownish to light cream, bearing a minute, sharp-pointed, calcareous spicule. Gills holobranchial, adanal with interspace and 41 ctenidia per side.

Distribution

Tonicia forbesii is widely distributed in the Eastern Pacific; from Mexico, Mazatlán to Taboga Island, Panama (Sliker, 2000). It is the only member of the Subfamily Tonicinae Pilsbry, 1893 as well as of the genus *Tonicia* in the Panamic Province.

Remarks

Our specimens correspond to the original description by Carpenter (1857). Two specimens from the rocky-coraline area presented a high grade of tegmentum erosion, especially on the central areas, while the other two specimens, collected in 50% living coral area, the central area is well preserved.

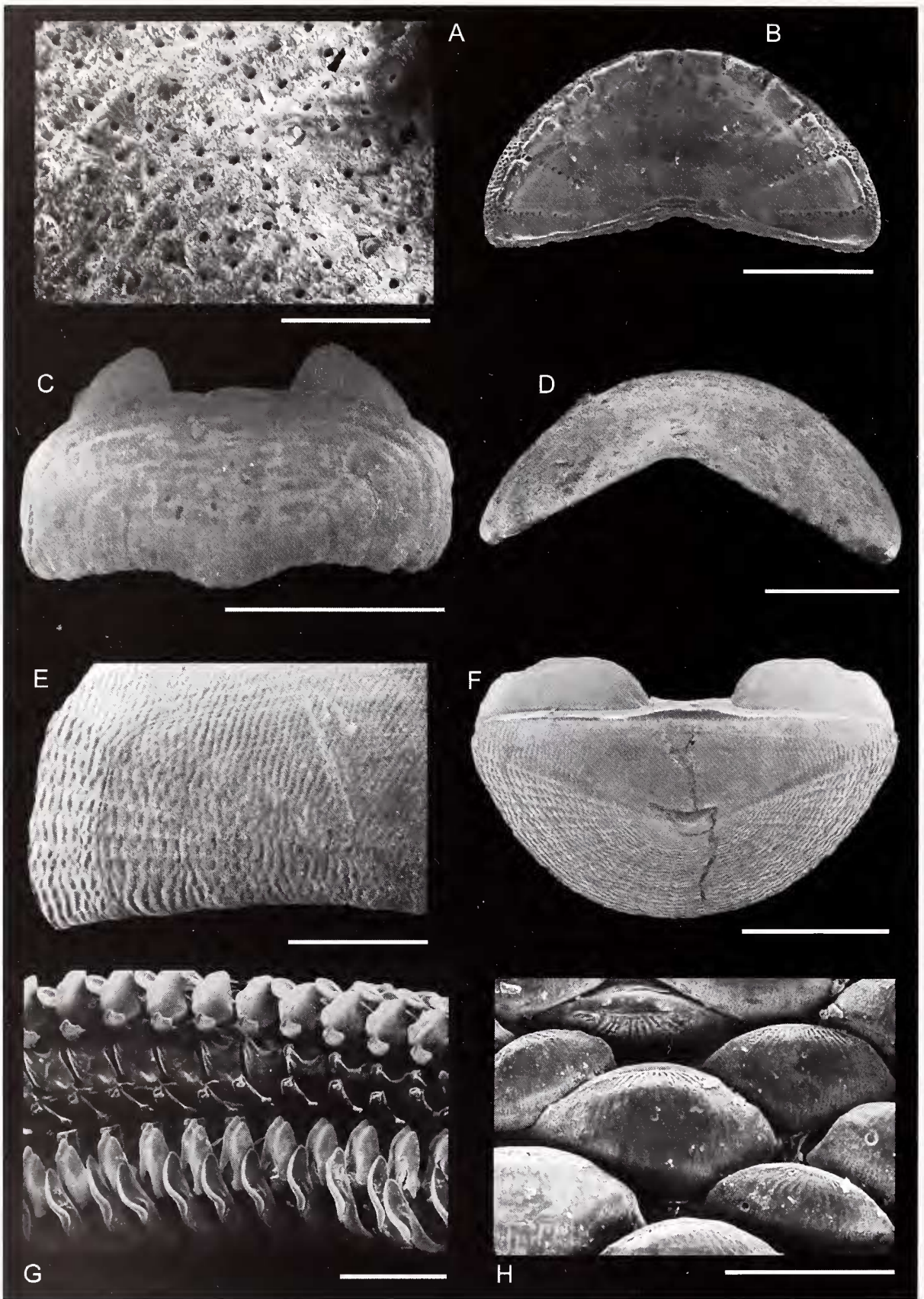


Fig. 3. SEM images. **A.** *Lepidochitona (L.) salvadorensis*, 7.0 × 5.0 mm, aesthete system of head valve (scale bar = 200 μm). **B.** *Lepidochitona (L.) salvadorensis*, 7.0 × 5.0 mm; head valve in ventral view (scale bar = 1 mm). **C.** *Lepidochitona* sp., 7.2 × 4.6 mm; dorsal view of an intermediate valve (scale bar = 2 mm). **D.** *Lepidochitona* sp., 7.2 × 4.6 mm; dorsal view of the head valve (scale bar = 2 mm). **E.** *Ischnochiton* sp., 21.7 × 10.4 mm; view of the lateral area sculpture (scale bar = 1 mm). **F.** *Ischnochiton* sp., 21.7 × 10.4 mm, dorsal view of the tail valve (scale bar = 2 mm). **G.** *Ischnochiton* sp., 21.7 × 10.4 mm; view of the radular teeth (scale bar = 200 μm). **H.** *Ischnochiton* sp., 21.7 × 10.4 mm; dorsal view of the girdle scales (scale bar = 200 μm).

Fig. 3. Immagini SEM. **A.** *Lepidochitona (L.) salvadorensis*, 7,0 × 5,0 mm; esteti della piastra anteriore (scala = 200 μm). **B.** *Lepidochitona (L.) salvadorensis*, 7,0 × 5,0 mm; piastra anteriore in vista ventrale (scala = 1 mm). **C.** *Lepidochitona* sp., 7,2 × 4,6 mm; vista dorsale di una piastra intermedia (scala = 2 mm). **D.** *Lepidochitona* sp., 7,2 × 4,6 mm; vista dorsale della piastra anteriore (scala = 2 mm). **E.** *Ischnochiton* sp., 21,7 × 10,4 mm; scultura sull'area laterale (scala = 1 mm). **F.** *Ischnochiton* sp., 21,7 × 10,4 mm, vista dorsale della piastra posteriore (scala = 2 mm). **G.** *Ischnochiton* sp., 21,7 × 10,4 mm; denti radulari (scala = 200 μm). **H.** *Ischnochiton* sp., 21,7 × 10,4 mm; vista dorsale delle scaglie sul perinoto (scala = 200 μm).

Family Ischnochitonidae Dall, 1899
Subfamily Chaetopleurinae Plate, 1899
Genus *Chaetopleura* Shuttleworth, 1853

Chaetopleura (Chaetopleura) lurida
(Sowerby in Broderip & Sowerby, 1832)
(Fig. 2B)

Chiton luridus Sowerby in Broderip & Sowerby, 1832: p. 26;
1833: fig. 20.

Chaetopleura lurida Thorpe in Keen, 1971: p. 887, fig. 41.

Chaetopleura lurida Abbott, 1974: p. 401.

Chaetopleura lurida Smith, 1977: p. 217, 243, 246.

Material examined

MHNUMAR-003-01074. Two specimens were studied, 25.3 × 16.1 mm and 23.2 × 15 mm, from Puerto Angelito, Puerto Escondido and Estacahuite, Puerto Angel. The specimens were found on 50% of living coral at Puerto Angelito, Puerto Escondido and Estacahuite area with rocky-coral bottom, at 4 m and 2 m, respectively.

Description

Medium sized chitons from 23 to 25.3 mm in length; elongated-oval. Colour brownish-green and dark gray predominating, with light cream small areas. Head valve semicircular, posterior margin V-shaped, hardly notched in the middle. Intermediate valves rectangular, posterior margin straight, lateral areas slightly raised; tail valve semicircular, smaller than head valve, length less than half of width, submedian mucro, postmucronal slope straight to slightly concave. Tegmentum pustulose on end valves and lateral areas of intermediate valves; pustules roundish, usually forming well defined radial rows; 14-24 pustulose rows on anterior valve, 10-16 on tail valve and 4-6 on lateral areas. Central areas with smaller pustules, often coalescing into granulate riblets. Mucro central or slightly anterior; postmucronal area of tail valve straight to concave. Articulamentum light bluish, apophyses white, short broadly triangular in valve II, subrectangular in valves III-VIII; jugal plate present. Slit formula 9-11/1/18-13. Radula with a central tooth distally wide, first lateral tooth cup-shaped, major lateral with a tridentate cusp, the central denticle largest. Girdle moderately wide, colour greyish green, dorsally densely covered with minute scales and abundant golden brown corneous hairs (not dendritic). Holobranchial or abanal gills with about 30 ctenidia per side.

Distribution

Chaetopleura (C.) lurida is continuously distributed from the central part of the Gulf of California, Mexico at Bahía de San Francisquito to the most southern record at Gorgonia Island at the north side of Colombia (Kaas & Van Belle, 1987). This species seems to be confined to the intertidal and shallow subtidal zones between 0 and 30 m.

Remarks

This species was clearly described by Ferreira (1983a), although he named this species as *Chaetopleura scabricula* (Sowerby, 1832) after a revision of the syntype of *Chiton luridus*. Kaas & Van Belle (1987) presented an interesting nomenclatural discussion and decided to retain the name *Chiton luridus*, of which *C. columbiensis* and *C. scabriculus* were considered synonyms. We follow Kaas & Van Belle's, remarking that Sowerby's description and figures are sufficient to recognize the species.

Ferreira (1983b) also studied insular Mexican specimens from Revillagigedo Islands, observing strong variations, like the tegmentum with small pustules conferring the specimens an almost smooth, rather than scabrous appearance. He concluded that these specimens are so different that can be placed as a subspecies of *Chaetopleura scabricula*, although he did not propose any subspecies name. We think that a detail taxonomic study is needed to establish if the tegmentum differences of these specimens are enough to support a subspecies status for the Revillagigedo specimens.

This species has been reported as abundant (Reyes-Gomez, 2004) and widely distributed in the eastern Pacific, common mainly at the entrance of the Mexican Tropical Pacific especially along Guerrero coasts. Many observations (A. Reyes, pers. obs.) have confirmed its wide intraspecific variation in colour, number and size of the tegmental pustules. Specimens from the southern areas of Mexican Tropical Pacific displays mainly brownish colour and dense pustules, whereas those from the northern side showed scattered pustules and brown greenish tegmentum colour.

Chaetopleura (C.) lurida can be found in a variety of habitats, mainly in low intertidal rocky shores and also in coralline habitats, as reported here. In this particular area we observed this species occurring at a depth of 4 m along with *Tonicia forbesii forbesii* and *Stenoplax (S.) limaciformis*, also sharing substrate and food resources (encrusting red and green algae). One of the specimens was collected in low intertidal (less than 1 m), whereas in coralline substrate only one chiton was collected.

Chaetopleura (Chaetopleura) hanselmani
(Ferreira, 1982)
(Fig. 2C)

Calloplax hanselmani Ferreira, 1982a: p. 321-324, figs 4-6.

Chaetopleura mixta Smith & Ferreira, 1977: p. 85, 86, figs 6, 7.

Material examined

MHNUMAR-003-00935. A very small (7.0 × 4.5 mm) specimen was collected at 5-7 m depth, on 50% of living coral at Casa Mixteca area with rocky-coral bottom on small stones in a sandy protected area.

Description

Small sized chiton, 7 m in length, elongate oval. Thick valves and colour very variable, from dark green to brown and cream. Head valve semicircular, tegmentum smooth, ornamented with large, strong and rounded pustules, arranged in 15 to 18 radial rows. Intermediate valves broadly rectangular; lateral areas moderately raised with 2-4 radial pustulose rows; central areas with longitudinal rows of smaller, less raised pustules, about 10 rows per side, smooth jugum. Valve VIII somewhat less than semicircular, as wide as head valve; anterior margin evenly convex; mucro central, conspicuous; postmucronal area with fewer and rather randomly placed pustules. Articulamentum strongly developed, wide apophyses, connected across the sinus by a short jugal plate; slit formula 8-9/1/9-10. Girdle with alternating brownish and lighter colored bands, covered dorsally with pointed spicules interspersed with smooth pointed ringshaft-needles of two types: one type larger and straight, the other type curved.

Distribution

It is a widely distributed species ranging from Mazatlán, Mexico to Island Lobos Afuera, Peru (Kaas & Van Belle, 1987), at 0-17 m depth.

Remarks

Ferreira (1982a) described this species as *Calloplax hanselmani*. Its position in *Calloplax* was mainly based on the fact that the holotype showed an elongated shape, valves with strong radial ribs or rows of pustules and girdle with spicules (not hairs) and coarsely striated scales. But Lyons (1985) recognized this species as a member *Chaetopleura* genus due to the girdle elements, considered as spicules (not scales) of two distinct type, differing from each other in size and shape. We follow Kaas & Van Belle (1987) that remarked the position in *Chaetopleura* and described in detail its morphology.

Some differences in the number of pustulose rows in the central area and the size of the spicules were observed in our specimen. However, due to its small size, we assume that this is juvenile specimen.

Family Ischnochitonidae Dall, 1899
Subfamily Ischnochitoninae Dall, 1899
Genus *Stenoplax* Carpenter ms, Dall, 1879
Subgenus *Stenoplax* s. s.

Stenoplax (Stenoplax) limaciformis
(Sowerby, 1832)
(Fig. 2E)

Chiton limaciformis Sowerby, 1832: p. 26, fig. 8.

Stenoplax limaciformis Thorpe in Keen, 1971: p. 81, fig. 24.

Stenoplax limaciformis Bullock, 1985: p. 294, figs 1-7, 8A,B, 9A.

Material examined

MHNUMAR-003-00472; MHNUMAR-003-01076. Five specimens were studied (22.4 × 7.8 mm, 24.6 × 8.1 mm, 25.9 × 8.7 mm, 28.1 × 10.5 mm, 33.0 × 12.1 mm) from Puerto Angelito and Estacahuite, at 4 m and 2 m respectively, 50% of living coral at Puerto Angelito, Puerto Escondido and Estacahuite area with rocky-coral bottom. These chitons were found in wave exposed areas and in intertidal area, together with *Chiton (C.) articulatus* and *Chiton (C.) albolineatus*.

Description

Large sized chiton from 30 to 35 mm in length; more than 1/3 of width, elongated oval shape. Tegmentum color highly variable, predominating with pink, light green-olivaceous, greyish and dark green, mostly in a speckled spotted pattern. Valves not beaked, valve I semi-oval notched in the middle; intermediate valves with the anterior margin forwardly produced, widely convex at both sides of the concave jugal part, lateral areas neatly marked and moderately raised. VIII large, almost wide as the intermediate valves; mucro central but not raised. Tegmentum with coarse concentric ribs, broken into pustules or nodules, especially on the head valve; lateral areas of the intermediate valves with broad, low, closed-packed concentric ribs, somewhat partly broken. Articulamentum weakly developed, greyish with suffusions of pink and dark areas in the apical part of the valves. Apophyses triangular, insertion plates short, slit formula 9-13/1/7-12, slits deep. Girdle moderate width, colored like tegmentum, covered with scales. Holo-branchial gills, abanal, about 27 ctenidia per side.

Distribution

Stenoplax (S.) limaciformis occurs from Puertecitos, Baja California, Mexico to Inner Lobos Island Peru (Bullock, 1985)

Remarks

This is a common species within the Mexican Pacific. For several years there was confusion about the conspecificity of *Stenoplax limaciformis* from the western Pacific; *Stenoplax purpuracens* C.B. Adams and *S. (Stenoplax) floridanus* Pilsbry distributed in the Caribbean. Bullock (1985) demonstrated that they are "sibling species", i.e. closely related species, reproductively isolated but morphologically identical or nearly so. The different species of the *Stenoplax limaciformis* complex are certainly very similar in appearance, but they're now geographically circumscribed and even when the Caribbean species occurs sympatrically with another species or the group, they showed small but consistent morphological differences (density of aesthete pores and radular denticle cap) that make the Caribbean members different from each other, and different from the Eastern Pacific *Stenoplax* species.

The distribution of *Stenoplax (Stenoplax) limaciformis* is restricted along the continuous continental margin, suggesting that the offshore zone is an effective geographical barrier due to its absence in insular environments (so far not reported in the Revillagigedo Archipelago, Cocos Island and the Galapagos Islands). Bullock (1985) reported that shell and radular morphology are quite uniform throughout its wide range.

Stenoplax (Stenoplax) mariposa
(Bartsch ms, Dall, 1919)
(Fig. 2M)

Ischnochiton mariposa Bartsch ms, Dall, 1909: p. 506.
Ischnochiton mariposa Smith A.G., 1977: p. 227, fig. 85.
Ischnochiton mariposa Ferreira, 1983b: p. 312, 313.
Stenoplax mariposa Keen, 1958: p. 528, fig. 46.

Material examined

MHNUMAR-003-00571. Two small specimens were found (14.5 × 4.1 mm, 14.3 × 4.2 mm) at Estacahuite, Puerto Ángel, Oaxaca at less of 1 m and 4 m of depth living corals, in between green and red algae, together with no other associated polyplacophoran species.

Description

Small sized chitons reaching 16 mm in length and 7.2 mm in width, elongated; valves dorsally elevated, slightly concave, not beaked. Color variable, mostly white-cream with dark green bands on both sides of jugum and large bright blue spots aside to mucronal area. Head valve semicircular, notched in the middle, posterior margin widely V-shaped; tegmentum with a shallow sculpture of wrinkled grooves concentric to notch. Intermediate valves rectangular, with lateral areas somewhat raised; sculpture consisting of irregular grooves forming a dentate posterior margin. Tail valve semi-oval, wide, with central mucro. Articulamentum very thin and translucent; apophyses short and wide; slit formula 9-10/1/7-10, slits rays are present on the ventral surface of the valves and smooth insertion teeth. Girdle wide, with small intricate scales that can be seen as smooth to the simple eye, but are ornamented with fine riblets. Radula with 43 rows of mature teeth in a specimen 12 mm long; major lateral tooth with tricuspid head. Gills holobranchial, adanal with interspace.

Distribution

It is reported as locally common, in low intertidal and shallow subtidal settings in the Gulf of California to Cabo Corrientes, Jalisco (Bullock, 1985). Here we report a wider distribution south to Oaxaca.

Remarks

Specimens of this species have been recognized also at Michoacán, Playa Zapote (A. Reyes, unpubl. data). They

are darker than those from Oaxaca. *Stenoplax (Stenoplax) mariposa* is very rare in the Mexican mollusc collections, and can be easily misidentified, due to the fact that the tegmentum sculpture is often not visible in adult specimens. The tegmentum was not visible when the valves were moister; we had to dried the valves dorsally so we can identified the type of tegmentum elements.

Live chitons are extremely colourful and were found more abundant at 4 m deep, always on living coral. This species is common in the Mexican Tropical Pacific (A. Reyes, unpubl. data) and can be misidentified as juveniles of *Ischnochiton muscarius*. The Mexican specimens have a lighter colour pattern, compared with the northern ones, which are mostly green and brown.

Family Ischnochitonidae Dall, 1899
Genus *Lepidozonia* Pilsbry, 1892
Subgenus *Lepidozonia* s. s.

Lepidozonia (Lepidozonia) serrata (Carpenter, 1864)
(Fig. 2I)

Ischnochiton serratus Carpenter, 1864: p. 315.
Lepidozonia serrata Ferreira, 1974: p. 172, figs 15-18.

Material examined

MHNUMAR-003-00572. One specimen of this species was studied (12.0 × 7.0 mm), collected at Chachacualjicaral, Bahías de Huatulco, Oaxaca at 4 m in a locality with 75% of living coral.

Description

Medium sized chitons, 12 mm long and 7 mm wide, oval shape; color variable, uniform cream, tones of brown with splashes of green, blue or even dark brown or gray. Head valve semicircular; tegmentum minutely granulose with about 20-22 low radial ribs. Intermediate valves rectangular; lateral areas moderately raised, with 3-6 flat ribs and a protruding jugal part; on the posterior margin there are well formed, elongated pustules giving a serrate appearance; central areas with about 15 longitudinal riblets parallel to jugum. Valve VIII less than semicircular, mucro well marked and postmucronal slope concave. Articulamentum glossy white, apophyses short, wide semi-oval, jugal plate weakly or not notched at the sides, slit formula of insertion plates 9-12/1-2/9-13, teeth short, sharp, eaves narrow. Girdle moderately narrow, colored like tegmentum, faintly banded, dorsally covered with rounded, small imbricating scales with ribs or with fine striations on the surface.

Distribution

Lepidozonia (L.) serrata has been reported continuously distributed from San Diego and Monterrey Bay, to Magdalena Bay and mostly in the Gulf of California from Cabo San Lucas to Pulmo Reef; Bahía de Palmas,

La Paz; Bahía San Carlos; Bahía San Marte; Punta Candeleros; Bahía de Concepción; Punta Chivato, Bahía San Luis Gonzaga and Puertecitos on the west side of the Gulf; Espíritu Santo Island; Los Islotes, Isla San Francisco; Isla Carmen Isla Coronados; Isla Tiburon; Bahía de Kino and Guaymas down to Tres Marias at the southwest of Mazatlán (Ferreira, 1974). Here we extend its distribution range to coralline area in the locality of Chachacual-Jicaral, Bahías de Huatulco, Oaxaca, Mexico.

Remarks

Ferreira (1974) discussed the phylogeny of this species, stating that the conchological characters of *Lepidozonia* (L.) *serrata* placed it far from *L. clathrata* (Reeve, 1847) or *L. mertensii* (Middendorff, 1847). Similar observations were mentioned by Pilsbry (1842), who decided to set the species in the genus *Ischnochiton* s.s. According to Ferreira (1974), *Lepidozonia* (L.) *serrata* shows typical *Lepidozonia* s.s. characters, such as the tegmentum with coarsely granulated and radial ribs and the girdle scales, as the result of a process of convergence, meaning that *L. (L.) serrata* came from a different evolutionary line, not directly from the *Lepidozonia* s.s. lineage.

On the other hand, Eernisse found on molecular phylogeny basis that *Lepidozonia* (L.) *serrata* is un-related to *Lepidozonia* s.s. and that may be placed in a new genus (Eernisse, per. comm. to A. Reyes). More studies are needed in order to define the systematic position of this species. In this work, we keep the recent classification for this species, but we agree on the fact that *Lepidozonia* (L.) *serrata* differs in several respects from the other members of *Lepidozonia* and could require a distinct position in a new genus.

Family Callistoplacidae Pilsbry, 1893 Dall, 1899

Genus *Callistoplax* Dall, 1882

Callistoplax retusa

(Sowerby in Broderip & Sowerby, 1832)

(Fig. 2F)

Chiton retusus Sowerby in Broderip & Sowerby, 1832: p. 28, fig. 82.

Callistoplax retusa Thiele, 1893: p. 393, pl. 32: fig. 13.

Callistoplax retusa Skoglund, 1989: p. 83.

Material examined

MHNUMAR-003-01069; MHNUMAR-003-00573. Two specimens were studied, 13.4 × 7.4 mm and 12.0 × 7.0 mm respectively, from Chachacual-Jicaral, Bahías de Huatulco (50% of living coral) and Estacahuite, Puerto Ángel (rocky-coral bottom).

Description

Medium sized chitons, 14-24 mm long and 8-9 mm wide, elongated shape, twice or more the width; valves

thick. Tegmentum mostly creamy yellow, sometimes with brownish streaks. Head valve semicircular, with outer margin scalloped and posterior margin concave and denticulated, hardly notched in the middle; tegmentum sculptured with nine strong widely radial ribs. Intermediate valves with short margins, central part generally eroded, apices small (if present); lateral areas highly raised, posteriorly denticulated, with two bifurcated radial ribs, jugal area smoothish. Central area with 10-12 converging granulate riblets. Tail valve semi-oval, about as wide as head valve, mucro elevated and postmucronal area convex with 6-7 thick, rounded radiating ribs. Articulamentum strongly developed, white, apophyses wide and rounded with a short jugal plate. Insertion plates short slit formula 7-9/1/9-12; no slits rays, teeth blunt, hardly thickened at the side-edges. Girdle narrow, light brownish, naked except for bunches of straight or curved chitinous bristles. Central tooth of radula squarish and major lateral with tricuspid cap. Gills holobranchial, abanal, with about 28 ctenidia per side in adult specimens.

Distribution

All along the western coast of Central America, between Islas Tres Marias, Mexico, south to Panama (Skoglund, 1989).

Remarks

Callistoplax retusa is the only representative of the genus *Callistoplax*, Dall, 1882 in the Mexican waters. It is a very distinctive species, because the hard tegmentum and its long shape, the nude girdle and the hairs are exclusively for this species. In the juvenile stages, the shape is oval and valves not so thick, whereas adults are markedly elongated, although some specimens can be not so elongated as the majority. A similar variability within adult stages are also present in other species, such as *Callistochiton elenensis* which the subject of a study on allometry by Ramirez-Torres & Eernisse (2006). They found that the change in shape from juvenile to mature stages might have adaptive consequences, such adaptation to microhabitat, leading to increased abilities in feeding and reproduction, and increased internal volume available for gonads and other soft tissues. However, extensive morphometric studies are needed for better understanding the factors which control such variations.

Family Chitonidae Rafinesque, 1815
Subfamily Chitoninae Rafinesque, 1815
Genus *Chiton* Linné, 1758

Chiton (Chiton) articulatus Sowerby, 1832 (Fig. 2G)

Chiton laevigatus Sowerby [in Broderip & Sowerby], 1832: p. 59, fig. 7.

Chiton (Diochiton) articulatus Bullock, 1988c: p. 170, 184, figs 4, 93, 107, 128-130, 136, 138, 142.

Chiton articulatus Skoglund, 1989: p. 86.

Chiton (Diochiton) articulatus – Reyes-Gomez, 2004: p. 72, fig. 51.

Material examined

MHNUMAR-003-01072; MHNUMAR-003-01073. Five specimens were studied (37.4 × 26.4 mm, 18.4 × 12.8 mm, 21.4 × 13.9 mm, 17.5 × 11.7 mm, 35 × 24.8 mm) at Cacaluta, Huatulco Bays, at 2 m of depth with 75% of living coral.

Description

Large size chiton species. 37.4 mm in length and 26.4 mm width. Tegmentum olive green, dark green and bluish green, occasionally with white to yellow areas and with darker concentric bands. Surface smooth, lateral areas barely raised with smooth growing lines on lateral areas; apice present; head valve not notched, somehow straight. Articulamentum white with central depression and greenish callus; slit rays hardly visible, small dentated teeth on insertion plate, slit formula 15-18/1/20-23; irregular dentated jugal plate. Girdle covered with large glossy scales, triangular shape on the posterior side. All around the girdle is alternately banded light and dark green. Central tooth of radula moderately narrow, rounded distally; wing of major lateral teeth broad somewhat pointed distally. Denticle cap nearly rounded.

Distribution

Mazatlán, Sinaloa to Puerto Angel and down far to Salina Cruz, Oaxaca (Reyes-Gomez, 2004).

Remarks

Chiton (Chiton) articulatus is one of the most common endemic species in the Eastern Mexican Pacific and with a locally economic importance due to the consumption of its foot all along the Mexican Pacific coast. This chiton is known by fishermen as “marine cockroach” in the north of Mexico or “dog’s tongue” in the south. Rojas-Herrera (1988), Holguín-Quiñónez & Michel-Morfín (2002) and Flores-Campaña (2007) have pointed out that the populations of *Chiton (C.) articulatus* are declining due to over-exploitation. According to Holguín-Quiñónez & Michel-Morfín (2002) the average relative density on rocky exposed shores, is 3.7 chitons/m², whereas in not accessible or protected areas, like rock fissures and in cracks of rock pinnacle, the average is 8.5 chitons/m². In our study area we found disarticulated valves of adult chitons all over the shores in areas near to urban areas, indicating the high consumption of this species.

Chiton (Chiton) albolineatus

Broderip & Sowerby, 1829

(Fig. 2H)

Chiton (Chiton) albolineatus Broderip & Sowerby, 1829: p. 63, fig. 11.

Chiton albolineatus Pilsbry, 1893: p. 160, pl. 32, fig. 2.

Chiton (C.) albolineatus Skoglund, 1989: p. 13.

Chiton (Chiton) albolineatus Reyes-Gomez, 2004: p. 72, fig. 49.

Material examined

MHNUMAR-003-01071; MHNUMAR-003-01074. Two specimens were studied (22.3 × 13.7 mm, 35.4 × 18.6 mm) from Cacaluta, Huatulco Bays at 2 m of depth. in a locality with 75% of living coral. This species was abundant in this locality, associated with *Stenoplax (S.) limaciformis*.

Description

Medium size chitons reaching 36 mm in length and 19 mm in width, somewhat flattened. Dark and light olive green colour on central areas, with two longitudinal white lines on mucronal area; lateral areas with numerous white transverse zig zag lines. Head valve slightly convex and strongly notched; tail valve with a post-mucronal slope straight and anterior mucro. Tegmentum smooth on central regions; lateral areas black, barely raised, with two concentric and irregularly ribs producing nodular branches. VIII with 9-11 low radiating ribs which irregularly bifurcate or like cut ribs. Articulamentum white and light green; slit rays present; insertion teeth deeply pectinate. Slit formula 15/1/12. Girdle gray; each scale bluish gray with light brown border; scales relatively small, roundly triangular shape, apical and dorso-lateral areas smooth.

Distribution

Chiton (C.) albolineatus is an endemic to the Mexican East Pacific and has been recorded by Reyes-Gomez (2004), from Isla Venados, North west of Mazatlán and Chivos Is., south of Playa Mazatlán, north of Punta Derecha, Bahía Ola Altas, Mazatlán; Isla Tres Marias, Manzanillo, Bahía Santiago, Acapulco. In the present work we extend its distribution to Huatulco Bays, Oaxaca. Its been also reported (Skoglund, 1989) from Guaymas, Mazatlán, south to Guatemala, but these records had not been supported by recent studies and needs confirmation.

Remarks

This species is easy to recognize for its coloration pattern. It is sometimes associated with *Ischnochiton (I.) muscarius*, *Chaetopleura (C.) lurida* and *Chiton (C.) articulatus*. Although it can reach a relatively large size, this species is not used for consumption due to its rather

small foot. Rich populations of this species can be found on rocky shores.

Family Acanthochitonidae Pilsbry, 1893
Subfamily Acanthochitoninae Pilsbry, 1893
Genus *Acanthochitona* Gray, 1921

Acanthochitona arragonites (Carpenter, 1857)
(Fig. 2J)

Acanthochites arragonites Carpenter, 1857: p. 90.
Acanthochites arragonites Carpenter, 1864: p. 650.
Acanthochitona arragonites Smith & Ferreira, 1977: p. 94.
Acanthochitona arragonites Kaas & Van Belle, 1980: p. 10.
Americhiton arragonites Watters, 1990: p. 267, figs 77-84, 90.

Material examined

MHNUMAR-003-01070, MHNUMAR-003-01077. Three specimens were studied (10.0 × 8.0 mm, 9.7 × 8.0 mm, 7.6 × 6.4 mm, at Estacahuite, Puerto Ángel, Oaxaca at 1 m deep in a locality with rocky-coral bottom substrate.

Description

Medium sized chiton; largest specimen about 10 mm in length; tegmentum of intermediate valves longer than wide, pentagonal. Color mainly white with green and gray tones, brown on latero-pleural areas. Jugum wide and apparently smooth due to erosion but it can bear worn small pustules, especially on inner edges. Head valve pustulose; pustules concentrically arranged from margin to apex of valve; inner edge elevated and thick. Latero-pleural areas coarsely granulose, with "D" shaped pustules. Tail valve with prominent, posterior mucro. Apophyses not extensive, slit formula 5/1/2; articulamentum white or green. Girdle dorsally covered with minute finely ribbed spicules and tufts around the girdle. Dorsum white, mottled with green and brown areas. Tufts present, short, with translucent, white or green spicules.

Distribution

This species is known from Sonora, Mexico down to Salinas, Ecuador (Watters, 1990).

Remarks

Acanthochitona arragonites was placed by Watters (1990) in the genus *Americhiton*, together with *Acanthochitona* Atlantic species (*Acanthochitona andersoni* Watters, 1981, *Acanthochitona balesae* Abbott, 1954 and *Acanthochitona zebra* Lyons, 1988). The genus *Americhiton* was characterized by its author by the pentagonal shape of intermediate valves and D-shaped pustules. Watters separated this genus from *Acanthochitona*, based on the shape of pustules, aesthete innervations and the number of macro and microesthetes in the tegmentum. In *Acan-*

thochitona the pustules are teardrop-shaped and micresthetes are distributed across the pustule, while in *Americhiton* the micresthetes are limited to the pre-pustular slope and pustules are D-shaped. All species placed within this genus are vermiform and their distribution is limited to the New World.

In the present work, we use *Acanthochitona* following Gray (1821), who was the first to separate it from the genus *Chiton*. He described a group of taxonomic characters that well define *Acanthochitona*: the tegmental reduction without lateral areas and the wide articulamentum, slit formula 5-1-12, spiculose girdle with 18 tufts, pustules that innervates macro and micresthetes system. Concerning *Americhiton* as a distinct genus, we think that the shell microstructure and DNA sequencing studies of *Acanthochitona* species are needed in order to establish the phylogenetic relation within the species of this complex species group.

Family Lepidochitonidea Dall, 1889
Genus *Lepidochitona* Gray, 1821

Lepidochitona sp.
(Figs 2K, 3C, D)

Material examined

MHNUMAR-003-00012. MHNUMAR-003-00571. Two specimens were studied (7.2 × 4.6 mm, 6.5 × 4.1 mm) from Playa Tlacopanocha and Estacahuite, Puerto Ángel, on rocky-coral bottom at less than 1 m of depth.

Description

Small sized chiton, from 7 to 9.4 mm in length and from 4.6 to 4.9 mm in width; mostly yellow with white, brown and green tones, irregularly dotted in white. Tegmentum microgranulose. All intermediate valves are rectangular and leave a small space between the adjacent ones. Head valve semicircular, posterior margin V-shaped, notched in the middle; same tegmentum sculpture as on the whole shell. Intermediate valves broadly rounded, posterior margin concave at both sides of the apex; lateral areas not raised and poorly defined. Tail valve semicircular, mucro slightly anterior and prominent. Girdle rather narrow covered with small juxtaposed spicules; spicules cylindrical and striated on the top. Major lateral tooth with four cusps, one of them is smaller than the other ones and it is located at one of the outer side of the tooth.

Remarks

This species differs from the known congeners, the specific characters are its rectangle valves shape, with its edges very close between each other, the major lateral tooth with four cusps, the striated spicules of the girdle, the elongated-oval body shape. *Lepidochitona* sp. is similar in body shape to *Lepidochitona beanii* and *Lepidochi-*

tona salvadorensis, except for the absence of the hairs in the girdle and the colour that in *Lepidochitona* sp. is yellowish to green, rather than reddish-brown as in *L. beaunii*. *Lepidochitona* sp. seems not abundant at Oaxaca and was also collected at Acapulco, Guerrero. This species will be described as new when more material will be available.

Family Ischnochitonidae Dall, 1889

Genus *Ischnochiton* Gray, 1847

Ischnochiton sp.
(Figs 2L, 3E-H)

Material examined

MHNUMAR-003-00014; MHNUMAR-003-00217; MHNUMAR-003-00591. Three specimens were studied (7.4 × 4.0 mm, 4.9 × 7.6 mm, 8.7 × 5.3 mm) from Estacahuite, Puerto Ángel, Mexico, on rocky-coral bottom in less than 1 m of depth.

Description

Large size species, 8.7 mm long and 5.3 mm wide. Chitons of brown and green tones, with a pattern of light to dark lines, to uniformly dark green. Tegmentum uniformly, finely, quincuncially granulated; lateral areas

raised, with a striated pattern that shows fine radial lines towards the mucronal area. Head valve semicircular, posterior margin V shaped, not notched in the middle but with a wide curvature; tegmentum striated with numerous radial fine lines. Intermediate valves broadly rectangular, apophyses wide and short. Tail valve semicircular; front margin rounded, mucro slightly antemedian and prominent; post-mucronal area with striated and with numerous radial lines towards the mucro. Girdle narrow, with imbricate striated scales that may form light and dark bands or a random pattern. Major lateral tooth plate shaped, slightly notched in the middle on upper margin.

Remarks

Ischnochiton sp. does not share any character with other members of this genus known for the Mexican Pacific and from South America. It has been misidentified in several mollusc collections as *Chiton* (*C.*) *articulatus*, with which it was found associated, due to the similar size, shape and other shell characters. This species will be described as new when more material will be available.

Discussion

In spite of its relatively small extension, the reef system of Oaxaca contains a rich and diverse chiton fauna con-

| Species | Locality | Depth | Substrate |
|---|--|--------------------------------------|---|
| <i>Lepidochitona</i> (<i>L.</i>) <i>salvadorensis</i> | Estacahuite | < 1 m | rocky-coraline |
| <i>Tonicia forbesii forbesii</i> | Chachacual-Jicaral, Bahías de Huatulco and Estacahuite | first locality at 4 m, second at 2 m | Chachacual-Jicaral 50% living coral, Estacahuite rocky-coraline |
| <i>Chaetopleura</i> (<i>C.</i>) <i>lurida</i> | Puerto Angelito, Puerto Escondido | first locality at 4 m, second at 2 m | Puerto Angelito and Puerto Escondido 50% living coral, Estacahuite rocky-coraline |
| <i>Chaetopleura</i> (<i>C.</i>) <i>hanselmani</i> | Casa Mixteca, Bahías de Huatulco | 5-7 m | 90% living coral |
| <i>Stenoplax</i> (<i>S.</i>) <i>limaciformis</i> | Puerto Angelito, Puerto Escondido and Estacahuite | first locality at 4 m, second at 2 m | Puerto Angelito and Puerto Escondido 50% living coral, Estacahuite rocky-coraline |
| <i>Stenoplax</i> (<i>S.</i>) <i>mariposa</i> | Estacahuite | < 1 m and 4 m | rocky-coraline and living coral |
| <i>Callistoplax retusa</i> | Chachacual-Jicaral, Bahías de Huatulco and Estacahuite | 2 m and < 1 m | 50% living coral |
| <i>Lepidozona</i> (<i>L.</i>) <i>serrata</i> | Chachacual-Jicaral, Bahías de Huatulco | 4 m | 75% living coral |
| <i>Chiton</i> (<i>C.</i>) <i>albolineatus</i> | Cacaluta, Bahías de Huatulco | 2 m | 75% living coral |
| <i>Chiton</i> (<i>C.</i>) <i>articulatus</i> | Estacahuite | < 1 m | rocky-coraline |
| <i>Acanthochitona arragonites</i> | Estacahuite | < 1 m | rocky-coraline |
| <i>Lepidochitona</i> sp. | Acapulco, Guerrero and Estacahuite | < 1 m | rocky-coraline |
| <i>Ischnochiton</i> sp. | Estacahuite | < 1 m | rocky-coraline |

Tab. 1. Data on depth (in meters) and substrate (percentage of coral and rocky bottom).

Tab. 1. Dati di profondità (in metri) e caratteri del substrato (percentuale di fondo a coralli e roccioso).

sisting of 13 species, all related somehow with the coral substrate (Tab. 1).

Several species recorded from Oaxaca were originally reported only from the Gulf of California. Two aspects about distribution are particularly interesting: first, it is clear that more exploration is needed to establish the real distribution of chitons along the Pacific side; second, the wide distribution of the species that are adapted to several habitat conditions, from the cold waters of the Gulf of Mexico to the warm reef areas.

The findings in Oaxaca's reef make us also consider the fact that this location represents the southern record for *Stenoplax* (*S.*) *mariposa* and *Lepidozona* (*L.*) *serrata*, for which there is no record yet from the entrance of the Mexican Tropical Pacific. This is common in both genera that contains species with an extraordinary wide range of distribution, and is the case of *Stenoplax* (*S.*) *limaciformis* that ranges south to Perú, *Lepidozona* (*L.*) *allysmithii* and *Lepidozona* (*L.*) *rothii* both distributed south to Costa Rica. We believe that a well programmed exploration in the entrance and down to the south of Mexico will clarify the distribution of many Mexican chiton species, and for most of the species distributed in the Golfo de California, especially for those that have been reported only from the type areas, and those species for which there are southern records needing con-

firmation. *Lepidochitona* (*L.*) *salvadorensis* is an example of South American species which is present in the Mexican waters too (Tab. 2).

The distribution of *Lepidochitona* sp. and *Ischnochiton* sp., is not restricted to Oaxaca's reef, as they are also present in the Mexican Tropical Pacific according to several observations made all along the coast of Guerrero (A. Reyes, pers. obs.).

We also pointed out intraspecific variations between northern and southern areas of distribution, for *Chaetopleura* (*C.*) *lurida* and *Chaetopleura* (*C.*) *hanselmani*, that showed differences mainly in the number and size of tegmentum elements. In the lack of other evidence, such differences are not enough to suggest a subspecific status. In other species the variations lies exclusively on the color pattern.

The reef system seems to allow several chiton species to find a variety of substrate on which they find protection and food resources. In the shores of Oaxaca, we did not find the same diversity and abundance of chitons recorded in the reef system. This is probably due to pollution from towns and local fisheries activities.

Other reef areas are present in the Mexican waters, such as the Sistema Arrecifal Veracruzano, located in the Gulf of Mexico, and the reefs in the Mexican Caribbean, both larger than the Oaxaca system and well known for their

| Species | Distribution | Remarks |
|---|--|--|
| <i>Lepidochitona</i> (<i>L.</i>) <i>salvadorensis</i> | Here recorded in Majahua, Guerrero and Puerto Ángel Oaxaca, Mexico to Los Cóbanos, Sonsonete and Playa Maculís, La Unión, El Salvador | Northern records in Mexican waters |
| <i>Tonicia forbesii forbesii</i> | Mexico, Mazatlán to Taboga Island, Panama | |
| <i>Chaetopleura</i> (<i>C.</i>) <i>lurida</i> | Bahía San Francisquito, Gulf of California to Northern Colombia, (Gorgona Island) | |
| <i>Chaetopleura</i> (<i>C.</i>) <i>hanselmani</i> | Between 23°13'N, Mazatlán, Mexico and 6°57'S, Lobos Afuera Is., Peru | |
| <i>Stenoplax</i> (<i>S.</i>) <i>limaciformis</i> | Gulf of California to Western coast of Central America, Inner Lobos Island, Peru | |
| <i>Stenoplax</i> (<i>S.</i>) <i>mariposa</i> | Gulf of California, Michoacán Playa Zapote; Revillagigedo Archipelago and here recorded in Estacahuite, Puerto Ángel, Oaxaca, Mexico | Extension of the distribution range |
| <i>Callistoplax retusa</i> | From Islas Tres Marías, Mexico, down to Panama | |
| <i>Lepidozona</i> (<i>L.</i>) <i>serrata</i> | San Diego and Monterrey Bay, California to Gulf of California, Mexico. Here recorded in Chachacual-Jicaral, Bahías de Huatulco, Oaxaca, Mexico | Extension of the distribution range to southern Mexico |
| <i>Chiton</i> (<i>C.</i>) <i>albolineatus</i> | Mazatlán, Sinaloa to Acapulco Guerrero and here recorded at Cacaluta, Huatulco Bays, Oaxaca, Mexico | Extension of the distribution range |
| <i>Chiton</i> (<i>C.</i>) <i>articulatus</i> | Mazatlán, Sinaloa to Puerto Angel and down far to Salina Cruz, Oaxaca, Mexico | |
| <i>Acanthochitona arragonites</i> | Gulf of California, Puerto Peñasco to Mazatlán; Estacahuite, Puerto Ángel, Oaxaca, Mexico down to Salinas, Ecuador | First record from southern Mexico |
| <i>Lepidochitona</i> sp. | Estacahuite, Puerto Ángel, Oaxaca, Mexico. Also present in Acapulco, Guerrero | |
| <i>Ischnochiton</i> sp. | Estacahuite, Puerto Ángel, Oaxaca, Mexico. Also present in Acapulco, Guerrero and Michoacán | |

Tab. 2. Distribution of chiton species occurring in Oaxaca's coralline system.

Tab. 2. Distribuzione geografica delle specie di chitoni presenti nel sistema corallino di Oaxaca.

high diversity in molluscs. Few chiton species have been reported from these areas, mainly because of the lack of studies in this group.

It has been remarked by Bullock (1985) and Clark (2000) that the chiton fauna from the eastern Pacific and the Caribbean regions show affinities in their taxonomic composition. Probably, such affinities originate from similar abilities to live on coral-related substrates.

In conclusion, it is likely that the investigation of reefs in other areas of Mexico could yield many more species of chitons than so far known.

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